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# PORTABLE PACKAGING DEVICE AND METHOD FOR FORMING INDIVIDUALLY PACKAGED ARTICLES

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## FIELD OF THE INVENTION

This invention relates to portable packaging devices useful with a length of non-resilient flexible tubular sheet material dispensed from the device for forming individually packaged articles from separated portions of the tubular film, as well as a method for forming a closed individually packaged article from the tubular sheet, employing the portable packaging device.

## BACKGROUND OF THE INVENTION

There is a substantial industry worldwide directed to the manufacture and use of packaging for articles of various types. As the world population becomes more mobile, they demand packaging for articles for use both inside and outside the home. For example, articles needed outside the home that can placed into closed individual packaging include personal use articles, such as cosmetics or sanitary products; foodstuffs, such as fruits, cereals, sandwiches, etc.; toys; business items; etc. Such articles may need to be enclosed in packaging that will remain securely sealed, will not open unexpectedly, will protect the article from moisture and other elements, or will contain undesirable elements of the article such as waste materials and malodor from escaping the package in order to protect the surrounding environment.

There is also a need to package articles acquired or accumulated outside the home, either for disposal or delivery, or for return. Such articles can include ones that may be odiferous and/or contaminated with waste products, including used disposable absorbent articles such as diapers (especially when containing a bowel movement) and sanitary products. Efforts have been made in the past to provide disposal devices that can be used to package such odiferous or contaminated articles until disposed. Such disposal devices have included basic waste pails such as those described in US Patent 5,158,199, issued to Pontius. Other devices include those that employ a mechanical features to dispense and/or enclose a plurality of waste articles into a disposal container, such as those disclosed in U.S. Patent 5,655,680, issued to Asbach et al.; US Patent 5,535,913, issued to Asbach et al.; Patent 6,065,272, issued to Lecomte; US

Patent 5,590,512, issued to Richards, et al.; US Patent 6,128,890, issued to Firth; US Patent 5,813,200, issued to Jacoby et al.; EP Publication 0,005,660-A, assigned to Scido; US Patent 3,452,368, issued to Couper; and US Patent 3,908,336, issued to Forslund. One such device is known as the Diaper Genie®, which is disclosed in US Patent 4,869,049, issued to Richards, et al. The product and the patent disclose a receptacle with a hinged closure, and a dispenser for a pack of layered, flexible tubular film that is fed into the annular opening of the receptacle. Waste diapers can be inserted into the tubing though the receptacle opening, and can be enclosed by gathering the trailing tubing with a rotatable removable lid that engages the tubing. The device can be replenished with refill tubular film from a refill cassette, as described in US Patent 4,934,529, issued to Richards, et al., which discloses a cassette having a tightly layered pack of tubular film positioned between a inner tubular core and an outer surrounding wall. The tubular film can be dispensed upward through an annular slot in a cap, and into the top opening of the device.

Despite these efforts to improve the packaging of articles, including odiferous and waste contaminated articles, there remains a need for improvements in the portability, flexibility, and effectiveness of devices for forming closed individually packaged articles.

## SUMMARY OF THE INVENTION

The invention provides a portable packaging device for manually forming individually packaging articles within a closed tubular sheet, preferably a tubular film. The device has an inlet end and an outlet end, and comprises a body formed by an inner core having an inlet opening and an outlet opening, and a passageway there between for passing there through an article to be packaged, a casing comprising a surrounding casing wall, and a base wall that joins an end of the surrounding casing wall to the body, the body and the casing defining a storage space and a dispensing opening at the inlet end, wherein the device can retain a length of non-resilient flexible tubular sheet within the storage space. The tubular sheet can be dispensed through the dispensing opening and into the inlet opening of the inner core. The article can be inserted inside the tubular film, and the tubular film can be gathered and closed at each end of the article, thereby forming a closed packaged article.

The device also comprises a means for separating the closed packaged article from a trailing portion of the tubular sheet, to remove the closed individually packaged article through the outlet opening, for disposal or other purpose. The device does not include a receptacle or container integral with the device for receiving the separated, closed packaged article. The means for separating the closed individually packaged article from the remaining trailing tubular

film enables immediate disposal, storage, or utilization, of the packaged article. The portable packaging device is convenient, portable, lightweight and easily maintained.

A preferred portable packaging device further comprises a layered pack of the flexible tubular sheet, and preferably a flexible thermoplastic tubular film. More preferably, the tubular sheet or film has an outer surface facing inward when the tubular film is passed through the inner core, the outer surface comprising an adhesive material at least intermittently applied thereto, whereby a leading portion and a trailing portion of the tubular sheet or film can be gathered on each side of article and closed with the adhesive material, thereby forming a sealed individually package article.

## BRIEF DESCRIPTION OF THE DRAWINGS

The various advantages of the present invention will become apparent to skilled artisans after studying the following specification and by reference to the drawings in which:

Figure 1 is a view of the portable dispensing device.

Figure 2 is a cross-sectional view of the portable dispensing device of Figure 1, containing the length of tubular sheet.

Figure 3 is a view of the device from the bottom, with a closed packaged article to be cut from the further trailing portion of the tubular sheet.

Figure 4 is a plan view of a three-dimensional film.

Figure 5 is a partial elevational sectional view of the three-dimensional film of Figure 4.

Figure 6 is a partial elevational sectional view similar to that of Figure 5, but depicting an adhesive included within the three-dimensional structure of the film.

## DETAILED DESCRIPTION OF THE INVENTION

The Portable Packaging Device

The portable packaging device 10 comprises a body 20 and a casing 14. The body 20 is formed of an inner core 22 having an inlet opening 23 and an outlet opening 24, with a passageway 25 there between. The article 100 to be packaged is inserted into the device 10 through the inlet opening 23, passes through the passageway 25, during which it is enclosed in the tubular sheet to form the packaged article 105, and is removed from the device 10 through the outlet opening 24. The cross-sectional shape of the passageway 25, or the shape of either or both the inlet opening 23 and outlet opening 24, can be circular, or can be preferably oval or elliptical. It has been found that an outlet opening and at least a portion of the passageway that are oval or elliptical can accommodate the human hand more readily than a circular shape. The passageway

can be cylindrical, wherein the axis along the passageway is a straight line, or elbowed, wherein the axis along the passageway is curved or non-linear. The selection of the shape and orientation of the passageway and openings can depend on design and aesthetic considerations of the use of the device.

As shown in Fig. 2, the casing 14 comprises a surrounding casing wall 16 and a base wall 18. The base wall 18 joins an end 17 of the surrounding casing wall 16 with the body 20. The casing 14 and the body 20 define a storage space 30 there between, as well as a dispensing opening 32 at the inlet end 12. The storage space 30 is occupied by the length 50 of flexible tubular sheet used to package the article. The dispensing opening 32 has an annular gap 33 out through which a leading edge 52 of the tubular sheet can be dispensed from the storage space.

The casing 14 also retains the length 50 of tubular sheet to prevent it from falling out though the dispensing opening 32 during use. An annular retainer cap 36 can be attached to either the casing 14 or the body 20, or can be integral with the inlet end 12 of either the casing 14 or body 20, or both. The cap covers a portion of the dispensing opening 32, thereby preventing the length of tubular sheet from falling out of the storage area in use. In a preferred embodiment shown in Fig. 2, the cap is an attachable annular ring attached to the inlet end 12 of the inner core 22 and extending radially outward into the dispensing opening 32, leaving the annular gap 33 out through which the tubular sheet is dispensed.

In the preferred embodiment shown in Fig. 1 and 2, the device 10 can comprise an annular protective cap 38, positioned to cover the dispensing opening 32 from the inlet direction. The protective cap 38 can be detachably or integrally affixed to the casing 14. The protective cap 38 can prevent other objects, as well are debris, dirt and liquids from spilling down onto the device 10 and in through the exposed dispensing opening 32. The protective cap 38 also serves as a convenient base on which other objects might be placed and stacked upon the device 10. The protective cap 38 is particularly useful when using a length 50 of tubular film having adhesive on the outer surface. The protective cap prevents contact and contamination of the adhesive surface that is exposed and facing upward as the tubular film is dispensed over the retaining cap 36 and into the inner core 22 of the device.

The length 50 of flexible tubular sheet is preferably formed into a layered stack 55 where the tubular sheet has been repeatedly folded alternately inward (to form an outer fold edge 58) and outward (to form an inner fold edge 56), as shown in Fig. 2. The resulting layered stack 55 of tubular sheet has an inner cylindrical surface 57 formed by the annular outer fold edges 56, and an outer cylindrical surface 59 formed by the annular inner fold edges 58. The effective diameter of the inner cylindrical surface 57 is selected to rest against or outside of an outside

surface of the inner core 22 of the body 20, and the effective diameter of the outer cylindrical surface 59 is selected to rest against or inside of an inner surface of the surrounding casing wall 16 of the body 20.

As shown in Fig. 3, the device 10 also comprises a means for separating the closed packaged article 105 from the further trailing tubular sheet 64. A preferred separating means comprises a cutting means 70, such as a knife-like cutting blade 74, that cuts through the gathered, closed tubular film behind the article. The cutting blade 74 can be a separate metallic blade, affixed or molded into the device, or can be a blade formed integrally from the material of the body 20 or casing 14, which is preferably a rigid plastic material. The cutting blade can also be a serrated blade or a blade having individually cutting teeth, such as one described in U.S. Patent 5,839,634. The cutting means 70 is preferably positioned at the outlet end 13 of the device 10, and can be integrally formed into a portion of the inner core 22 or the casing 14, as shown in Fig. 1 and 3. Optionally, the separating means can be integrated with a gather compression means, such as slot 78, to both close and separate the packaged article 105 in one continuous step.

The device can optionally include a funnel member attachable to the inlet end of the device to facilitate the insertion of articles in through the inlet opening. The funnel member has a wide inlet opening and a narrow outlet opening aligned with, of the same shape and size as, the inlet opening of the inner core. The tubular film dispensed from the storage space is passed up and over the wide inlet opening and down through the funnel and in through the inlet opening of the inner core.

The tubular sheet can be any flexible sheet material that has been formed into a tubular shape. The tubular sheet material is preferably non-resilient so that it can take and retain more easily any shape into which it is formed. The tubular sheet material can have portions that are, or can be entirely, transparent, translucent, or opaque. The sheet material can be formed into a tubular form by well-known methods. Preferred tubular sheet materials are thermoplastic non-resilient flexible films, and more preferred for waste article disposal use are thermoplastic, vapor-impermeable film materials, fabricated from a polymer which can be made from homogeneous resins or blends thereof. Single or multiple layers within the film structure are contemplated, whether co-extruded, extrusion-coated, laminated or combined by other known means. Useful resins include, but are not limited to, polyethylenes (PE) (including high density polyethylene, HDPE, low density polyethylene, LDPE and linear low density polyethylene, LLDPE), polypropylene (PP), polyethylene terephthalate (PET), polyvinyl chloride (PVC), polyvinylidene chloride (PVDC), latex structures, nylon, and surlyn. Polyolefins are generally preferred due to

their lower cost and ease of forming but are not necessary to practice the invention, with high density polyethylene (HDPE) being most preferred to fabricate the film sheet. Other suitable materials to fabricate the film from include, but are not limited to, aluminum foil, coated (waxed, etc.) and uncoated paper, coated and uncoated wovens, scrims, meshes, nonwovens, and perforated or porous films, and combinations thereof. The flexible film sheet material can also be a three-dimensionally shaped formed film, having a film thickness of from about 0.0001 inch (0.1 mil) to about 0.009 inches (9 mil), more preferably about 0.001 inch (1 mil).

A particular preferred tubular sheet has an outer surface that comprises an adhesive material. The outer surface is the surface that will face inward when the tubular sheet is positioned inside the passageway 25. The adhesive material can be applied to the outer surface continuously, intermittently, in areas along the length that alternate with non-adhesive portions of the film. The adhesive facilitates the closing of the leading portion and the trailing portion of the tubular sheet on each side of article, and forms a more secure closure. A preferred adhesive material is a pressure-sensitive adhesive material.

A preferred the tubular film comprises a three-dimensional film having an adhesive applied on one surface. A particularly preferred tubular film is described in U.S. Patent Nos. 5,871,607 (Hamilton et al.), 5,662,758 (Hamilton et al.), 5,968,633 (Hamilton et al.), and 5,965,235 (McGuire et al.), the disclosures of which are incorporated herein by reference. The three-dimensional film has an outer surface that comprises a plurality of recessed pressure sensitive adhesive sites and a plurality of collapsible protrusions that serve as stand-offs to prevent premature sticking of the adhesive sites to a target surface until a force sufficient to collapse the protrusions has been applied to the opposed surface of the film. When a tubular film is used which comprises the plurality of adhesive sites and collapsible protrusions uniformly, the tubular film will close and seal securely at the leading and trailing gathers. The film can also be adhered to the enclosed article by firmly impressing the film against the enclosed article. This can provide advantages, in preventing the enclosed article(s) from moving about within the closed package, and in making the closed individually packaged article more rigid, and thereby more resistant to premature loosening and opening of the gathered closures.

Referring to Fig. 4, there is shown a plan view of a representative three-dimensional film, which is generally indicated as 132. Film 132 has a plurality of non-uniformly shaped and sized, preferably hollow, protrusions 134, surrounded by spaces or valleys 136 therebetween, which are preferably interconnected to form a continuous network of spaces within the amorphous pattern. In a preferred embodiment, the width of spaces 136 is preferably substantially constant throughout the pattern of protrusions.

Protrusions 136 are preferably spaced center to center an average distance of approximately two protrusion base diameters or closer, in order to minimize the volume of valleys between protrusions and hence the amount of substance located between them. For applications where it is intended that the protrusions be deformable, the protrusions 136 preferably have heights which are less than their diameters, so that when they deform, they deform by substantially inverting and/or crushing along an axis which is substantially perpendicular to a plane of the film. This protrusion shape and mode of deforming discourages protrusions 136 from folding over in a direction parallel to a plane of the film so that the protrusions cannot block a substance (if present) in the valley between them from contact with a target surface.

Figs. 5 and 6 depict fragmentary elevational cross-sections of film 132 taken at a location where a complete protrusion 134 and both adjoining spaces or valleys 136 can be seen in cross-section. Fig. 5 depicts the three-dimensional structure of Fig. 4 by itself, with no adhesive or other substance added to the film. In this view, the upper surface of the film which faces the viewer of Fig. 4, and which includes the projecting portions of the protrusions 134, is identified with the numeral 115, and is referred to hereafter as the male side of the film. Correspondingly, the lower surface of the film facing away from the viewer of Fig. 4, which includes the openings of the hollow portions of the protrusions 134, is identified with the numeral 117, and is referred to hereafter as the female side of the film.

Fig. 6 shows the structure of Fig. 4, analogously to Fig. 5, but with a substance 140 added to spaces 136, as well as to the hollow underside of the protrusions 134, in accordance with the teachings of commonly-assigned, co-pending concurrently-filed U.S. patent application Ser. No. 08/744,850 now U.S. Pat. No. 5,871,607, Attorney's Docket No. Case 5922R, filed Nov. 8, 1996, in the names of Peter W. Hamilton and Kenneth S. McGuire, entitled "Material Having A Substance Protected By Deformable Standoffs and Method of Making", the disclosure of which is hereby incorporated herein by reference. Substance 140 partially fills the spaces 136 so that an outer surface of protrusions 134 remain external to the surface level of substance 140 such that the protrusions prevent the substance 140 on the male side of the film from making contact with external surfaces. With regard to the male side of the film, substance 140 partially fills the hollow protrusions such that the reverse side of the valleys or spaces between respective protrusions serves an analogous function in preventing substance 140 within the protrusions from making contact with external surfaces. Substances within different sides of the film 132 and/or within different geometrically-distinct zones within a side of film 132 need not be the same substance and could in fact be distinctly different substances serving distinctly different

functions.

"Substance" is defined in this invention as any material capable of being held in open valleys and/or depressions of a three dimensional structure. In the present invention, the term "substance" can mean a flowable substance which is substantially non-flowing prior to delivery to a target surface. "Substance" can also mean a material which doesn't flow at all, such as a fibrous or other interlocking material. "Substance" may mean a fluid or a solid. Adhesives, electrostatics, mechanical interlocking, capillary attraction, surface adsorption, and friction, for example, may be used to hold the substances in the valleys and/or depressions. The substances may be permanently held in the valleys and/or depressions, or the substances may be intended to be released therefrom when exposed to contact with external surfaces or when the three dimensional film is deformed, heated, or otherwise activated. Of current interest in the present invention include substances such as gels, pastes, foams, powders, agglomerated particles, prills, microencapsulated liquids, waxes, suspensions, liquids, and combinations thereof.

The spaces in the three-dimensional structure of the present invention are normally open; therefore it is desirable to have substances stay in place and not run out of the structure without an activation step. The activation step of the present invention is preferably deformation of the three-dimensional film by compression. However, an activation step to cause substance to flow could be heating the material to above room temperature or cooling it below room temperature. Or it could include providing forces excessive of the earth's gravity. It could also include other deforming forces, such as tensile forces and combinations of these activation phenomena.

In a particularly preferred embodiment, protrusions 136 have an average base diameter of about 0.015 inches (0.038 cm) to about 0.030 inches (0.076 cm), and more preferably about 0.025 inches (0.064 cm). They also have an average center-to-center spacing of from 0.03 inches (0.08 cm) to 0.06 inches (0.15 cm), and more preferably about 0.05 inches (0.13 cm) spacing. This results in a high number density of protrusions. The more protrusions per unit area, the thinner the piece of film and protrusion walls can be in order to resist a given deformation force. In a preferred embodiment the number of protrusions per square inch exceeds 200 and the protrusions occupy from about 30% to about 70% of the protrusion side of the piece of film. They have a protrusion height of about 0.004 inches (0.010 cm) to 0.012 inches (0.030 cm), and more preferably about 0.006 inches (0.015 cm) height. The preferred material is 0.0003 inch (0.0076 mm) nominal thickness high density polyethylene (HDPE).

For fabrication of an adhesive-containing, three-dimensional, film, a preferred layer of substance 140 is preferably a latex pressure sensitive adhesive about 0.001 inch (0.025 mm) thick. Even more preferably, layer of substance 140 may be about 0.0005 inch (0.013 mm) thick

layer to about 0.002 inch (0.051 mm) thick layer of hot melt adhesive, specification no. Fuller HL-2115X, made by H. B. Fuller Co. of Vadnais Heights, Minn. Any adhesive can be used which suits the needs of the material application. Adhesives may be refastenable, releasable, permanent, or otherwise. The size and spacing of protrusions is preferably selected to provide a continuous adhesive path surrounding protrusions so that air-tight seals may be made with a target surface.

Film materials may be made from homogeneous resins or blends thereof Single or multiple layers within the film structure are contemplated, whether co-extruded, extrusion-coated, laminated or combined by other known means. The key attribute of the film material is that it be formable to produce protrusions and valleys. Useful resins include polyethylene, polypropylene, PET, PVC, PVDC, latex structures, nylon, etc. Polyolefins are generally preferred due to their lower cost and ease of forming. Preferred material gauges are about 0.0001 inches (0.0025 mm) to about 0.010 inches (0.25 mm). More preferred gauges are from about 0.0002 inches (0.005 mm) to about 0.002 inches (0.051 mm). Even more preferred gauges are from about 0.0003 inches (0.0076 mm) to about 0.001 inches (0.025 mm).

The length 50 of tubular sheet retained within the device 10 is most preferably in a layered pack, consisting of a plurality of pleats formed by repeatedly folding equivalent pleat lengths of the continuous tubular sheet inwardly and outwardly.

The use of tubular films having an adhesive on one surface can require special consideration in the design and use of the packaging device. For example, use of a tubular sheet having adhesive on the outer surface should try to avoid contacting or pulling the adhesive surface across edges or surfaces of the device, such as the casing 14, the retainer cap 36, and the rim of the inlet opening 23 of the inner core 22. For this reason, tacky adhesives should be avoided, in favor of pressure-sensitive adhesives and three-dimensional tubular films having an adhesive surface that is recessed. The adhesive can be food grade or not food grade. A preferred adhesive is a hot melt adhesive that is light colored, has a viscosity in the range of 1,500 to 36,000cP measured within a temperature range of 270°F to 350°F, and a softening point temperature in the range of 100°F to 350°F.

The layered stack 55 of tubular sheet material can be inserted or removed from the casing 14 though either the inlet end 12 or the outlet end 13 of the casing 14, by removing either the annular retainer cap 36, or the base wall 18, respectively. In Fig. 2, the refill can be inserted most conveniently by removing the protective cap 38 and the retainer cap 36. The refill pack of layered film can consist simply of a pack of film that is constrained such as by ties or shrink wrapping, and which is inserted into the storage space, after which the ties and constrains are

removed. Alternatively, a portion of the refill pack can comprise a replacement inner core or parts or the whole of the casing, which replace corresponding parts on the device.

The stack of tubular sheet can be formed for the refill pack, or for the packaging device, by well known methods, such as described in U.S. Patent No. 5,056,293, issued to Richards et al., incorporated herein by reference.

A preferred process comprises feeding the tubular film by engaging the length of tubular film on its inside surface when forming and layering the plurality of pleats in a tubular pack. A flat sheet of flexible plastic film is unwound from a roll and over a forming horn to form the film into a tube, which is then sealed by a heated sealing roller. The tubular film runs outside and over a cylindrical feed mandrel having a plurality of vertical slots cut from its base up toward the feed end. Inside the slotted mandrel is a reciprocating piston with six (6) fingers, which can extend through the slots. This piston is driven by a cam mechanism and moves axially up and down within the slotted mandrel. The fingers are controlled by an eccentric (mounted on the cam) and a series of link arms. The link arms and eccentric allow the fingers to move in and out as the eccentric rotates (i.e., the effective circumference of the fingers changes as the eccentric rotates). The packing motion of this reciprocating device is: (1) piston moves up with retracted fingers, (2) fingers extend, (3) piston moves down with fingers extended, (4) finger retract. This differential circumference of the fingers as they extend and retract is what allows the reciprocating device to grab and release the tubular film as pleats of the tubular film are formed in the annular space between the two mandrels. The film is stacked in the annular space onto a base comprising a pair of indexing jaws. These jaws index down throughout the process so the distance between the fingers at the bottom of their stroke and the top of the packed pleated tubing is always constant. When the desired amount of pleated tubular film has been formed, the feed tubing is cut, and the indexing jaws separate, move upward above the pleated pack, close, and move downward, thereby pushing the layered pack of tubular film from around the slotted mandrel.

In a preferred process, the length of tubular sheet has adhesive on an outer surface as it is being fed and packed into the layered configuration. To avoid exerting the film driving means (such as rollers) onto the adhesive surface of the tubular film, special considerations in the process and the apparatus are required to avoid contacting the machine parts with the surface containing the adhesive.

A preferred apparatus for forming a pleated layered pack of tubular sheet from a length of flexible tubular sheet material, having an inner surface, comprises:

a) a central mandrel having a film receiving end and a base end, an external circumference determined by an internal diameter for each layered pack, and a plurality of slots positioned circumferentially around the central mandrel and extending axially from the base end and ending toward the film receiving end,

b) a base positioned at the base end of the central mandrel,

c) a means for feeding the tubular film onto the central mandrel in pleated layers, comprising

i) an engaging means registered with each slot, having an extended position extending through the slot to contact the inner surface of the tubular film, and a retracted position within the central mandrel,

ii) an extending means for moving the engaging means radially between the extended position and the retracted position,

iii) a reciprocating means for moving the engaging means axially between a pickup position near the film receiving end of the slot, and a deposit position toward the base end, and

iv) a drive means for driving the extending means and the reciprocating means in synchronized timing, wherein the engaging means proceed through a cycle of:

a) the extended position at the pickup position, thereby engaging the inner surface of the tubular film,

b) the extended position at the deposit position, thereby pulling the tubular film down to form a pleated layer,

c) the retracted position at the deposit position, thereby disengaging from the inner surface of the pleated tubular film, and

d) the retracted position at the pickup, thereby returning to the beginning of the cycle,

thereby forming the pleated layered pack of tubular sheet.

In a further preferred apparatus for packing a tubular film with adhesive on one surface, which can avoid excessive compacting of the layers, the apparatus further comprises an indexing means by which the relative distance of the engaging means between the pickup position and the deposit position is maintained substantially constant. The indexing means preferably comprises a means for indexing the base axially downward from the deposit position, substantially by a distance equal to the thickness of a formed pleat (which is essentially twice the thickness of the tubular film). The apparatus can also comprise a means for holding the formed pleat as the engaging means disengages and returns to the pickup position to engage a subsequent length of

tubing for the next pleat. The holding means can comprise a plurality of fingers that extend through additional holding slots in the central mandrel to hold the inner surface of the tubular sheet, or can comprise a means to hold the outer surface of the tubular sheet. When the apparatus will form a series of layered packs of tubular film, the apparatus will further comprise a means for severing the layered portion of the tubular film from a remaining portion of the tubular film, and a means for discharging the severed tubular film from around the central mandrel as a layered pack.

Alternatively, the length of flexible tubular sheet can be arranged in a radially folded manner, as described in European Publication 0,005,660-A1, hereby incorporated by reference.

Method of Forming Closed Individually Packaged Articles

The present invention also provide for an improved method for manually forming a closed individually packaged article from a tubular sheet. The improved method is particularly convenient and effective for the disposal of waste-containing disposable absorbent articles. The method comprises the steps of:

a. providing a portable packaging device 10 having an inlet end 12 and an outlet end 13, comprising a body 20 formed by an inner core 22 having an inlet opening 23 and an outlet opening 24, and a passageway 25 there between for passing there through an article 100 to be packaged, and a casing 14 comprising a surrounding casing wall 16, and an base wall 18 that joins an end of the surrounding casing wall 16 to the body 20, the body 20 and the surrounding casing wall 16 defining a storage space 30 and a dispensing opening 32 at the inlet end 12,

b. providing a length of flexible tubular sheet retained within the storage space, the tubular sheet having a leading edge 52 and a trailing portion 62 that follows the leading edge 52,

c. dispensing the leading edge from the storage space through the dispensing opening and the inlet opening, and into the passageway of the inner core,

d. gathering and closing the leading edge, thereby forming with the trailing portion a receiving pouch 60 within the passageway of the inner core,

e. inserting an article 100 to be packaged by a user of the device into the receiving pouch,

f. gathering the trailing portion behind the article,

g. closing the gathered trailing portion 63, and

h. separating the closed individually packaged article 105 from a further trailing portion 64 of the tubular sheet at the closed gathered trailing portion.

The leading edge 52 is the circumferential edge of the tubular film. It is brought up out of the storage space through the annular gap 33 of the outlet opening 24 at the inlet of the device.

The leading edge 52 is gathered together and closed, preferably sufficiently closed to resist and prevent the closed portion from later prematurely loosening and opening. The leading edge can be closed by tying a simple knot in the end, or by clamping or taping the gathered edge tightly. In a preferred embodiment where the tubular sheet has an adhesive applied to the outside surface (which is the surface facing inward after the tubing has been inserted into the passageway), the gathered leading edge is self-closing with the adhesive. Inserted into the device through the inlet opening and down into the passageway, the gathered, closed leading edge 53, together with the tubing that trails behind the leading edge, forms the pouch 60 for receiving the article 100.

Inserting the closed leading edge 53 into the passageway positions the receiving pouch 60 down inside the passageway of the device, with the trailing film extending upward and outward over the inlet edges of the device. The article 100 to be packaged is then inserted down into the device and into the receiving pouch. The receiving pouch can hold one or more than one article, or large number of smaller articles, combined into a single package. In the case of waste-containing disposable diapers, for example, two diapers (or more, depending the diaper size and the size of the device) could be inserted into the receiving pouch.

The portion of tubular film that extends behind the pouched article is then gathered behind the article to close the tubular film and form the individually packaged article. The gathering can be accomplished manually be many well-known means, as by twisting the article in the pouch, or by pulling the circumference of the tubular film together, or by bringing together opposing sides of the tubular sheet. Most simply, the users inserts a hand in through the outlet opening, and grasps by hand and twists the individually packaged article to gather and close the trailing portion of the tubular film.

To assist in the effective gathering and closing of the trailing portion of the tubular sheet, the device can optional comprise a gather compression means to exert forces upon the gather, thereby forming a better closure of the sheet. The gather compression means is particularly useful with tubular sheets using certain non-resilient flexible films such as low density polyethylene (LDPE), high density polyethylene (HPPE), and linear low density polyethylene (LLDPE) or combinations thereof, which retain a shape after being manipulated thereto under force, or with tubular sheets having an adhesive on at least one surface which can bind to itself or to other portions of the tubular sheet and create a strong closure and an effective seal. A preferred gather compression means comprises a slot 78 having narrow and/or tapering sidewalls, which compress against the gathered tubular sheet as the gather is pulled through the slot.

To ensure the gathered portion remains closed, a securement means can be used. Effective means for securing the closure include adhesives, adhesive tapes, ties, etc. Suitable adhesive tapes include film tapes and paper tapes. The device 10 can optionally comprise an integral tape dispenser for dispensing a piece of tape to be used to close the gathered tubular film at each end of the article.

In a preferred embodiment, the closed individually packaged article is sealed with air-tight, leak-proof closures or seals. In this embodiment, the tubular film is preferably a thermoplastic vapor-impermeable film material. The leak-proof package and seals work both ways: to keep any liquids, odors (and malodors), or gases inside the package from escaping, and to keep any moisture or gases in the environment from entering into the package. Particularly preferred, for both its simplicity and effectiveness, is a self-sealing adhesive tubular film, which can securely enclose, contain, and seal the article without separate closure means. The selection of adhesive should take into out the adhesives softening temperature and other properties to ensure that the seal can be sustained at even extreme ambient temperatures (both hot and cold). A method for testing the security of the seals is described in the Closure Integrity Method, hereinafter described.

After forming the closed packaged article, the method comprises separating the packaged article 105 from the further trailing portion 64 of tubular sheet. Most conveniently, the method comprises separating the article by cutting through the gathered trailing portion 63 using a cutting means 70, such as the cutting blade 74 as shown in Fig. 3. Conventional means of cutting through the trailing tubular sheet, such as the use of scissors or a knife, are options to the user, though are inconvenient and particularly unsafe and highly undesirable when traveling outside the home.

In an alternative embodiment, the separating means can be incorporated into the tubular sheet itself, whereby the tubular film can be readily separated one portion from another, as hereinafter described.

In one preferred embodiment, the tubular sheet will have along its length separable regions, generally through the circumference of the tubular sheet, that are position between remaining lengths of the tubular sheet. The separable regions can be manually opened, by tearing or forcefully pulling the sheet on either side of the separable region, thereby separated one portion of the tubular sheet from another portion along the separable region. The separable region can by torn or ruptured by hand more easily than can the remaining portions of the tubular film. The separable region can comprise one or more lines of weakening around at least a portion of, though preferably entirely around, the circumference of the separable region, and can

comprise perforations, score lines, and combinations thereof. The separable region can also comprise a region of the sheet that is thinner, or is made of a more weakened material, than that of the remaining tubular film. This permits manual separation of the closed individually packaged article 105 from the remaining length of tubular film without resort to a cutting element, scissors, etc.

The components parts of the device 10, including the body 20, inner core, casing, retaining cap, and protective cap, are preferably made of resilient plastics, including but not limited to polyethylenes (PE) (including high density polyethylene, HDPE), low density polyethylene, LDPE and linear low density polyethylene, LLDPE), polypropylene (PP), polyethylene terephthalate (PET), polyvinyl chloride (PVC), polyvinylidene chloride (PVDC), latex structures, nylon, and surlyn, although other rigid, resilient materials (e.g., fiberboard, sheet metal) can be used.

To facilitate the convenient handling of the device by hand, and to carry it about, the device can optionally comprising a handle either integrally formed with or detachable from the casing 14 or body 20 of the device. The device can also comprise a mounting element for removably securing the device to a corresponding receiver element positioned on a wall, tabletop, etc.

To facilitate grasping and holding of the device during transport or use, the outer surface of the casing 14 can be covered with an anti-slip material, such as a rubber coating. The outer surface of the casing can also be formed with ribs, ridges, nubs, protrusions, or other surface aberrations to facilitate an improved grip with less slippage in the hand.

Closure Integrity Method

The test the security of a seal formed by the gathered, closed tubular sheet, the following method is used to exert a positive pressure inside the closed individually packaged article to determine the pressure at which the seal will fail; that is, the pressure differential at which the gathered closure will un-gather or loosen, thereby permitting air inside the packaged article to escape.

A sample of the packaged article within a tubular film with both ends gathered and closed, is prepared, and placed in the fixture test stand of a SKYE 2000 equipment (Modem Controls, Inc.) to measure the rupture pressure of the seals of the sample. A sealing septum is applied to the film and a hollowed needle that is part of the test stand equipment is inserted generally in the middle of the packaged article through the hole in the septum. A controlled supply of compressed air is attached to the needle inlet. The required rate of increase of pressure

is selected from a maximum range of 120 psig/minute to a minimum rate of 6 psig/minute, depending on the package type. Very slowly, the internal pressure inside the closed packaged article is increased from +0 psig/minute to 6 psig/minute (310 mm Hg) (where "psig" is pounds force gauge per square inch) until one or the other seal fails and air begins to leak from the interior of the packaged article through the seal. The internal pressure at which the seal(s) fails is recorded.

Clean, unsoiled baby diapers are selected as the article. Three types of film are used: 1) commercially available Saran® plastic wrap, formed into a tubular film, 2) polyethylene plastic bag (1 mil or 25 microns thick), and 3) a three-dimensional formed film (0.5 mil or 13 microns thick) having a pressure sensitive adhesive applied to one surface (Impress® sealable plastic wrap, available from The Procter & Gamble Company), formed into a tubular film.

Test samples using the Impress® sealable plastic wrap and using the Saran® plastic wrap are formed into closed individually packaged articles, according to the present invention, using two full turns of the closed gather tubular film at each end. Samples using the polyethylene plastic bag are placed into the bags, and the open end of the bag is tied in a knot.

Ten samples for each film are tested. The articles closed using the Saran® plastic wrap maintain a seal up to an average internal pressure differential of +0.1 psig (+5 mm Hg), before the gathered seal at one end or another fails. The closed packaged articles using the Impress® sealable plastic wrap maintain a seal up to an average internal pressure differential of +0.8 psig (+41 mm Hg), before the gathered seal at one end or another fails. The closed packaged articles using the polyethylene plastic film bags maintain a seal up to an average pressure differential of +0.7 psig (+36 mm Hg), before one of the bag side seams ruptures.

A particularly preferred closed individually packaged article, using pressure-sensitive adhesive on one surface of the film with a manually twisted, gathered closure on either side of the article, can maintain an airtight seal at an ambient temperature of 35°C with an internal differential pressure of about 0.5 psig (+26 mm Hg).

The various advantages of the present invention will become apparent to those skilled in the art after a study of the foregoing specification and following claims.